



# हिमाचल प्रदेश केंद्रीय विश्वविद्यालय Central University of Himachal Pradesh

(Established under Central Universities Act 2009)

PO Box no. 21, Dharamshala, Distt. Kangra, Himachal Pradesh- 176215  
(Temporary Academic Block, Shahpur)

**Course Code: ENV 535**

**Course Name: Natural Hazards**

**Credit Equivalent:** 2 Credits (1 Credit is equivalent to 10 hours of theory (Classroom activity) and 5 hours of practical (Laboratory work).

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organized classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory;/ literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed to

- Introduce the students to various kinds of Natural Hazards
- Students will be familiarized with causes of different Natural Hazards
- Students will also be exposed to region specific Natural Hazards
- Students will learn about occurrences of Natural Hazards in Indian perspective

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25%

(Depending upon the nature of the course, a teacher shall specify the breakup of each criterion into different components like written examination, assignment, field study, seminar/ presentation, class participation, problem solving exercises, practicals etc.)

**Course Contents**

**UNIT I**

**(2 Hours)**

- Definition and Classification of Hazards
- Phases of a Hazard/Disaster
- Effects of Hazards
- Prevention, Mitigation and Preparedness

**UNIT II**

**(4 Hours)**

- Atmospheric Hazards
  - Tropical Cyclones

- Tornadoes
- Blizzards
- Hail Storms
- Severe Thunderstorms
- Extreme Temperatures

### UNIT III

(6 Hours)

- Geologic Hazards
  - Earthquakes
  - Volcanic Eruptions
  - Tsunami
  - Landslides
  - Subsidence
  - Mass-movement
  - Mudslides
  - Avalanches
  - Impacts with space objects

### UNIT IV

(4 Hours)

- Hydrologic Hazards
  - Floods
  - Wave action
  - Drought
  - Rapid glacier advance & Retreat

### UNIT V

(4 Hours)

- Other Hazards
  - Biological
  - Technological
  - Wild Fire

#### Prescribed Text Books:

- a. **Tarback E. J. and Lutgens F. K. (1996). An introduction to Physical Geology.** Prentice Hall, New Jersey; ISBN 0-13-371584-1
- b. **Kumar K. (1998). Course Material of “Foundation Course in Disaster Management” of School of Social Sciences - Indira Gandhi National Open University; ISBN 81-7605-236-X to ISBN 81-7605-248- X**
- c. **Valdiya K. S. (1987). Environmental Geology (Indian Context).** Tata-McGraw-Hill, New Delhi

#### Reference Books

1. **Edward Bryant (2005).** Natural Hazards, Cambridge University Press
2. **Coates Donald R. (1985).** Geology and Society. Chapman and Hall, NY
3. **Keller Edward A. (1996).** Environmental Geology. Prentice-Hall, NJ
4. **Valdiya K. S. (2001).** Geology, Environment and Society. University Press, Hyderabad



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PO Box no. 21, Dharamshala, Distt. Kangra, Himachal Pradesh- 176215

**(Temporary Academic Block, Shahpur)**

**Course Code: ENV 573**

**Course Name: Water Resource Management**

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed to:

- Introduce the concept water resource management and its movement through the hydrological cycle
- Understand the distribution of surface and groundwater resources.
- Understand basic concepts and methods for rain water harvesting and its use for agriculture, drinking etc.
- Understand different techniques for artificial recharge of ground water.
- Understand different structures as well as some of the traditional practices prevalent in this country for water conservation

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25% (Breakup is following)
  - a. Assignment/Quiz/: 40%
  - b. Presentation/Seminar/: 40%
  - c. Class participation: 20%

**Course Contents:**

**Unit I**

**4 hrs**

- Brief outline of historic development
- Water usage in evolution of history
- Water Resources Development Scenario
- Global and Indian Water Scenario

**Unit II**

**4 hrs**

- World water resources: dimension and challenges
- Hydrological cycle

- Global water supply-demand management
- Environmental impacts and water resource management

### Unit III

6hrs

- Groundwater
- structures of aquifers
- Aquifer capacity
- Determining aquifer flow velocity-Darcy Law
- Integrated water resource management (IWRM) and virtual water

### Unit IV

6 hrs

- Water harvesting techniques in hilly region
- Artificial ground water recharge techniques and designs: artificial recharge techniques, direct methods, combination methods, ground water conservation techniques both modern and traditional
- Snow harvesting, roof top harvesting and dew drop harvesting
- Sustainable agriculture and irrigation

### Suggested Readings:

1. Patel, A. S., Shah, D. L., (2007): Water Management: Conservation, Harvesting and Artificial Recharge, New Age International, ISBN: 9788122422245.
2. (2001): Standard Guidelines for Artificial Recharge of Ground Water, EWRI/ASCE 34-01 illustrated ed Edition, American Society Of Civil Engineers, ISBN: 9780784405482.
3. Huisman, L., (1982): Artificial Groundwater Recharge (Monographs and surveys in water resources engineering) ISBN: 9780273085447.
4. CGWB, (2007): Manual on artificial recharge of ground water, Ministry of Water Resources, Central Ground Water Board.Govt. of India.
5. UNEP, (2009): Rainwater Harvesting: A Lifeline for Human Well-Being, United Nations Environment Programme, ISBN: 9789280730197.
6. Heather Kinkade-Levario, (2007): Design for Water: Rainwater Harvesting, Stormwater Catchment, and Alternate Water Reuse, New Society Publishers, ISBN: 9780865715806.
7. Piyooosh Rautela, M. L. Dewan, (2007): Water Resources in The Himalayas: Harvesting, Tradition and Change, Concept Publishing, ISBN: 9788170228042.
8. Ljiljana Baird, (2011): How to 'Harvest' Water: The Art of Saving Water, National Trust, ISBN: 9781907892004



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PO Box no. 21, Dharamshala, Distt. Kangra, Himachal Pradesh- 176215

**(Temporary Academic Block, Shahpur)**

**Course Code: ENV 580**

**Course Name: Recent Trends in Glaciology**

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed to:

- Understand the use of mass balance techniques for evaluating the health of a glacier
- Understand Recent advances in the field of glaciology
- Understand the importance of glacier in water resources management and palaeoclimatic studies
- Review the status of national as well as international ongoing glaciological research

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25% (Breakup is following)
  - a. Assignment/Quiz/: 40%
  - b. Presentation/Seminar/: 40%
  - c. Class participation: 20%

**Course Contents:**

## UNIT I

6 hrs

### Glacier Mass Balance and Processes

- Surface mass balance
- Mass balance variations of mountain glaciers
- Englacial mass balance
- Basal mass balance
- Mass loss by calving
- Glaciological method for determining glacier mass balance

## UNIT II

6 hrs

### Glacier Hydrology

- Surface hydrology

- Englacial hydrology
- Subglacial Hydrology
- Runoff from glaciers
- Methods for determining glacial runoff

### UNIT III

6 hrs

#### Recent Advances in Glaciology

- Glacial remote sensing
- Glacier Hazard monitoring
- Palaeo – climatology
- Glacial surges
- Different instruments used for studying glacier fluctuations

### UNIT V

2 hrs

#### Status of Glaciological Research

- A global overview
- Indian scenario
- Polar Research (Arctic and Antarctic scientific expeditions)

#### Suggested Readings:

1. Bryn Hubbard, Neil F. Glasser (2005): Field Techniques in Glaciology and Glacial Geomorphology, John Wiley & Sons.
2. Peter G. Knight (2008): Glacier Science and Environmental Change, John Wiley & Sons.
3. W. Kenneth Hamblin & Eric H. Christiansen (2003): Earth's Dynamic Systems (10th Edition), Prentice Hall.
4. Georg Kaser, Andrew Fountain and Peter Jansson (2003): A manual for monitoring the mass balance of mountain glaciers, IHP-VI, Technical Documents in Hydrology, No. 59, UNESCO, Paris.
5. Ostrem, G. & Brugman M (1991): Glacier mass balance measurements, a manual for field and office work, NHRI Science Report No. 4.  
Kurt M. Cuffey & W. S. B. Paterson, (2010): The Physics of Glaciers, Fourth Edition, Elsevier, ISBN No. 9780123694614.
6. Encyclopedia of Snow, Ice and Glaciers (2011): Springer, ISBN No. 9789048126415.
7. Douglas I. Benn, David J. A. Evans (2010): Glaciers & Glaciation, Oxford University Press, USA.
8. M. J. Hambrey (1994) : Glacial Environments, UCL Press.



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PO Box no. 21, Dharamshala, Distt. Kangra, Himachal Pradesh- 176215  
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**Course Code:** ENV 409

**Course Name:** Environmental Microbiology

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed to:

- Enable students to know and understand the role of beneficial microorganisms in the environment to benefit society.
- The students will acquire knowledge to investigate microbial diversity existing in different habitats in the natural ecosystems for mining and exploiting for novel natural products as well as for remediation of organic and inorganic contaminants in the environment.
- Evaluate the microbial communication, activities and interactions with their environment and their impact on ecosystem stability.
- Search for new microbes in extreme environments that may be useful for the discovery of high value “green” products that can be used in medicine, agriculture and industry.
- Enhance our understanding of the microbial communities in order to achieve environmental stability

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25%
  - a. Assignment: 10%
  - b. Class Test: 5%
  - c. Presentation: 10%

**Course Contents:**

**UNIT (I)**

**3 hrs**

1. Introduction to Microorganisms: General characteristics, Microbial diversity.
2. Historical perspective and scope of Environmental Microbiology.
3. A brief idea of techniques relating to isolation, purification and culture of microorganisms.

**UNIT (II)****3 hrs**

1. Microbial habitat: Microbes in extreme environments.

**UNIT (III)****6/ hrs**

1. Types of interaction between plants and microbes
2. Agriculturally important soil microorganisms: PGPRs, PGPF and sustainable agriculture
3. Methanotrophs

**UNIT (IV)****4 hrs**

1. Microbes and public health: Global change and microbial infectious diseases of human beings.
2. Microorganisms and bioterrorism: Microbial agents of concern as weapons of Bioterrorism.

**UNIT (V)****4 hrs**

1. Microbially induced corrosions and biofilms
2. Bioremediation of :
  - Organic contaminants: Biodegradation of organic pollutants- alkanes, aromatic hydrocarbons.
  - Metal contaminants - A brief account of toxic metals in Environment, Microbial approaches in the remediation of metal contaminated soils and sediments, and aquatic systems.

**Textbooks**

1. Environmental Microbiology, Raina M. Maier, Ian L. Pepper, Charles P. Gerba, 2009. (2<sup>nd</sup> Edition), Academic Press.
2. Environmental Microbiology Alan H. Varnam & Malcolm G. Evans; Publisher- Manson Publishing Ltd. 73 Corringham Road London NW 11 7DL, UK.

**Reference Books**

- Prescott, Harley and Klein's 2008. Microbiology (seventh edition), McGraw Hill
- Larry L. Barton, Diana E. Northup, 2011. Microbial Ecology, Wiley-Blackwell A John Wiley and Sons INC., Publications
- G. Bitton, 2005, Wastewater Microbiology (3<sup>rd</sup> Edition), John Wiley and Sons
- Text Book of Environmental Microbiology, Pradipta K. Mohapatra; Publisher: I.K. International Publishing House Pvt. Ltd. S-25, Green Park Extension Uphaar Cinema Market, New Delhi- 110016
- P. D. Sharma, 2011. Microbiology (2<sup>rd</sup> Edition), Rastogi Publications





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PO Box no. 21, Dharamshala, Distt. Kangra, Himachal Pradesh- 176215  
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**Course Code: ENV 503**

**Course Name: Environmental Legislation: National and International**

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organized classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed:

- To familiarize the students with fundamental right to clean environment and duties.
- The students will realize and underline the need for environmental legislations, and legislative powers of the Parliament.
- Students will acquire knowledge about different Environmental legislations at national level and conventions/protocols/treaties for conservation of Environment at international level.
- Students will learn about the Environmental legislation enforcement authorities, Environmental dispute redress bodies and the International Organizations for Conservation of Environment.

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

4. Mid Term Examination: 25%
5. End Term Examination: 50%
6. Continuous Internal Assessment : 25%
  - d. Assignment: 10%
  - e. Class Test: 5%
  - f. Presentation: 10%

## **COURSE CONTENT**

**UNIT (I)**

**1 hrs**

1. Introduction to Environmental Law, Powers of the Parliament to legislate Environmental legislations.
2. Status of Environmental legislations in India: Enumeration of Environmental legislations.

**UNIT (II)**

**4 hrs**

**Legislation enforcement authorities under:**

1. The **Environmental** water (Prevention and Control of Pollution) Act, 1974 – composition, powers and functions.
2. The Air (Prevention and Control of Pollution) Act, 1981 – composition, powers and functions.
3. The Environment (Protection) Act, 1986 – powers, EIA Notification, 2006.

#### **UNIT (III)**

**5 hrs**

##### **Environmental legislations and dispute redress bodies in India:**

1. The Wildlife (Protection) Act, 1972: Objectives, National Board for Wildlife (NBWL)
2. The Forest (Conservation) Act, 1980: Objectives and Mechanism.
3. The Biological Diversity Act, 2002: Objectives, National Biodiversity Authority.
4. National Green Tribunal- Composition and jurisdiction

#### **UNIT (IV)**

**2 hrs**

1. International Organizations for Conservation of Environment: UNEP, WWF, IUCN, IGBP.

#### **UNIT (V)**

**8 hrs**

##### **International Environmental Conventions, Protocols and Treaties:**

1. Ramsar Convention on Wetlands.
2. United Nations Conventions and Protocols on Climate Change, Ozone depletion, Biodiversity, Forest and Agenda -21.

#### **TEXTBOOKS**

1. Environmental Laws, 2005. Universal Law Publishing.
2. S.C. Santra, 2005, Environmental Science, New Central Book Agency (P) Ltd 8/1 Chintamani Das Lane, Kolkata- 700009

#### **REFERENCE BOOKS**

1. S. Diwan and A. Rosencranz, 2005, Environmental Laws and Policy in India.
2. Mallick, M. R. (Justice) 2010. Environmental Laws, Professional Book Publisher New Delhi
3. Rana S. V. S. 2005, Essentials of Ecology and Environmental Science, Prentice Hall of India Pvt. Ltd. New Delhi.



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PO Box no. 21, Dharamshala, Distt. Kangra, Himachal Pradesh- 176215

**(Temporary Academic Block, Shahpur)**

**Course Code:** ENV408

**Course Name:** Biodiversity and Wildlife Management

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed to:

- Introduce students to know kinds, distribution significance and use of Biodiversity and wildlife.
- The students will acquire knowledge to study, save and conserve Biodiversity and Wildlife.
- Explore the concepts related to identification, monitoring and assessment of Biodiversity and Wildlife.

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

7. Mid Term Examination: 25%
8. End Term Examination: 50%
9. Continuous Internal Assessment : 25% (Breakup is following)
  - a. Assignment/Quiz/Term Paper: 20%
  - b. Presentation/Seminar/Field work: 20%
  - c. Practical: 60%

**Course Contents:**

## UNIT I

4 hrs

Concepts of Biodiversity, Levels of Biodiversity, Mega Diversity areas, Hot Spots of the Biodiversity, Biodiversity Resources in Himachal Pradesh, Dependence on Biodiversity.

## UNIT II

4 hrs

Loss of of Biodiversity, Monitoring and Invetorization of Biodiversity, Alpha, Beta and Gamma diversities. Shanon Index. Biodiversity data base in Himalayas, Threat Categorization of Biodiversity, Documenation of Biodiversity.

## UNIT III

4 hrs

Modern Techniques of Measurement and Assessment of Biodiversty, Economics of Biodiversity, Uses of Biodiversity (including folk and traditional uses).

## UNIT IV

4 hrs

*EX-SITU* Conservation methods of Biodiversity, *IN-SITU* Conservation methods of Biodiversity, Protected areas Networks

## UNIT V

4 hrs

Wildlife distribution at National and Global level, Wildlife trade, Wildlife Sanctuaries, National Parks, Biosphere Reserves, Tiger Projects, Elephant Projects Crocodile Projects

### TEXT BOOKS

1. **Khan, T.I. 2001.** Global Biodiversity and Environmental Conservation. Pointer Publisher. Jaipur
2. **Kotwal, P.C. and Banerjee, S. 1998.** Biodiversity Conservation – in managed forests & protected areas. Agro Botanica Publishers & Distributors. PP.227. ISBN: 81-87167-00-9.
3. **Ramkrishnam, N. 2006.** Biodiversity in Indian Scenarios. Daya Publishing House, New Delhi. PP.338. ISBN: 81-7035-443-9.

### REFERENCE BOOKS

1. **Agarwal, K.C. 1998.** Biodiversity. Agro Botanica, Bikaner. PP. 150.
2. **Agarwal, S.K. et.al. 1996.** Biodiversity and Environment. A.P.H. Publishing Corporation. PP.351. ISBN: 81-7024-740-3.
3. **Biswas, S. 2007.** Biodiversity Conservation (A genetic approach). Oxford Book Company. PP. 347. ISBN : 81-89473-01-8.
4. **Chakraborty, S. 2004.** Biodiversity. Pointer Publishers. PP. 136. ISBN: 81-7132-384-7.
5. **Chaudhari, A.B. and Sarkar, D.D. 2002.** Biodiversity Endangered (India's threatened wildlife and medicinal plants). Scientific Publishers, Jodhpur, India. PP. 359. ISBN: 81-7233-312-9.
6. **Dhyani, S.N. 1994.** Wildlife Management. Rawat Publications, Jaipur (Raj.). PP. 258. ISBN: 81-7033-242-5.
7. **Ildos, A.S. and Bardelli, G.G.** The Great National Parks of the World. Om Book Service, New Delhi. PP.320. ISBN: 81-87107-06-5.



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PO Box no. 21, Dharamshala, Distt. Kangra, Himachal Pradesh- 176215  
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**Course Code:** ENV-412

**Course Name:** Analytical Technique

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed to:

1. introduce students to the fundamental concepts of analytical techniques environmental monitoring;
2. provide knowledge about various kinds of quantitative techniques;
3. Introduce about computation of analytical results, significant figures, concept of error, precision and accuracy, standard deviation, rejection of doubtful values.

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25% (Breakup is following)
  - a. Assignment/Quiz/Term Paper: 20%
  - b. Presentation/Seminar/Field work: 20%
  - c. Practical: 60%

**Course Contents:**

**UNIT I**

**(4 hrs)**

Computation of analytical results, significant figures, concept of error, precision and accuracy, standard deviation, rejection of doubtful values with special reference to volumetric and gravimetric analysis, calibration of analytical equipments.

**UNIT II**

**(4 hrs)**

Methods of expressing concentrations, primary and secondary standards. Theory and indicators for neutralizations, oxidation- reduction, precipitation titration.

### UNIT III

(4 hrs)

Method of gravimetric analysis, physical gravimetry, thermogravimetry and combustion analysis, precipitative gravimetric analysis, electrodeposition.

### UNIT IV

(4 hrs)

**Complexometric titrations** Complexometric methods using EDTA, principle of complexometric titrations, chelating agents, indicators, titrations with disodium edetate.

### UNIT V

(4 hrs)

**Nonaqueous titrations** General discussion and principle of titrations in non-aqueous media, aprotic, protophil protogenic and amphiprotic solvents. Titrations with perchloric acid, potassium methoxide and tetrabutyl ammonium hydroxide.

### TEXT BOOKS

1. G.H. Jeffery, J. Bassett. J. Mendham and R.C. Denney Vogel's Text Book of Quantitative Chemical Analysis 5<sup>th</sup> ed., ELBS, U.K. 1989.
2. Kenneth & A. Connors, A Text Book of Analysis, 3<sup>rd</sup> ed. Wiley interscience Singapore, 1982.
3. **e- book:** Pant D., Lab Manual Quantitative Analytical Method Book Rix Publication [www.bookrix.com](http://www.bookrix.com)

### REFERENCE BOOKS

1. Christian, Gary D. Analytical chemistry.-- New.Delhi: Wiley, 2004.
2. Shrivastava, M. L. Bioanalytical techniques.-- New.Delhi: Narosa, 2008.
3. Quevauviller P. and Thompson K. C., Analytical Methods for Drinking Water: Advances in Sampling and Analysis, John Wiley & Sons, Ltd. ISBN: 0-470-09491-5.
4. Harvey D. Modern Analytical Chemistry, McGraw-Hill Higher Education, New Delhi



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PO Box no. 21, Dharamshala, Distt. Kangra, Himachal Pradesh- 176215  
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**Course Code: ENV 422**

**Course Name: Basics of Natural Resource Conservation**

**Credit Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** The course is designed to:

1. To develop understanding about the natural resources
2. Classification of renewable and non-renewable resources
3. Mineral wealth of the nation and distribution of mineral deposits
4. Energy needs and resources availability
5. Sustainable development and management of resources

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

**Evaluation Criteria:**

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25%(Breakup is following)
  - a. Assignment/Quiz/Term Paper: 20%
  - b. Presentation/Seminar/Field work: 20%
  - c. Practical: 60%

**Course contents**

**UNIT I**

**(3 hrs)**

Basic concept of Natural Resource Conservation

Definition and understanding of land, water, soil, plant and animal resources

Resources that determine the quality of life

Broad classification of resources, mainly renewable and non-renewable resources

**UNIT II**

**(6 hrs)**

Economic Minerals and their classification and distribution (Global and national level)

Metallic and non-metallic mineral resources including mineral reserves and ore minerals

Non renewable resources to meet energy requirements mainly coal, oil and natural gas

Mineral occurrences, exploration, and prospects

**UNIT III**

**(3 hrs)**

Renewable energy resources such as hydropower which also includes tidal power and ocean surface waves for power generation

Wind power, Geothermal power and Solar power

**UNIT IV**

**(4 hrs)**

Sustainable development

Urban planning, and

Environmental management

**UNIT V**

**(4 hrs)**

Understanding the resource ecology

Life-supporting capacity of resources

Economic models: Green building concept- green technology concept.

**TEXT BOOKS**

1. **Chiras D D, Reganold J P and Owen O S. Natural resource Conservation: Management for a sustainable future.** Prentice Hall Publishers, ISBN 0-13-145832.
2. **Kesler S E. Mineral resources Economics and the Environment.** Prentice Hall Publishers (Pearson Education), ISBN: 0023628421.
3. **Gangstad E O 1990. Natural resource management of water and land.** Van Nostrand Reinhold. ISBN 0442004818, 9780442004811.

**REFERENCE BOOKS:**

1. **Simmons I G 1995. Earth, Air and Water: Resources and Environment in the Late 20th Century.** John Wiley & Sons Inc., ISBN 0470249706, 9780470249703.
2. National Research Council (U.S.). Committee on Selected Biological Problems in the Humid Tropics, 1982. **Ecological aspects of development in the humid tropics.** National Academy Press, ISBN 0309032350, 9780309032353.
3. **Shenk T M and Franklin A M 2001. Modeling in Natural Resource Management, Development, Interpretation and Application.** Island Press, 1-55963-739-0.
4. **Ayensu E, Heywood V H, Lucas G L and Defilipps R A, 1984 Our Green and Living World: The Wisdom to Save It.** Cambridge university press, ISBN 9780521268424.
5. **Blewitt J. Understanding Sustainable Development.** Earthscan Ltd., ISBN 1844074544.
6. **Prasad U 2005. Economic Geology : Economic Mineral Deposits.** 2<sup>nd</sup> edition, CBS Publishers & Distributors, ISBN 8123904606, 9788123904603.
7. **Kula E 1992. Economics of Natural Resources and the Environment.** Chapman & Hall, London, ISBN 0-412-36330-5.





# हिमाचल प्रदेश केंद्रीय विश्वविद्यालय Central University of Himachal Pradesh

(Established under Central Universities Act 2009)

PO Box no. 21, Dharamshala, Distt. Kangra, Himachal Pradesh- 176215

**(Temporary Academic Block, Shahpur)**

**Course Code:** ENV 528

**Course Name:** Nano-techniques and Environment

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

### **Course Objectives:**

- This course will cover fundamental principles of nanotechnology as well as its implications and applications for the environment.
- This course will be taught in an interactive, active-learning fashion, and it will be based on the textbook and primary literature in environmental nanotechnology.

### **Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

### **Evaluation Criteria:**

- Mid Term Examination: 25%
- End Term Examination: 50%
- Continuous Internal Assessment : 25% (Breakup is following)
  - a. Assignment/Quiz/Term Paper: 20%
  - b. Presentation/Seminar/Field work: 20%
  - c. Practical: 60%

### **Course Contents:**

#### **UNIT I**

**4 hrs**

**INTRODUCTION:** Background of nanotechnology, particle size and surface area, quantum dot. Converging science and technology, nanotechnology as a tool for sustainability, health, safety and environmental issues.

#### **UNIT II**

**4 hrs**

**SYNTHESIS AND FABRICATION OF NANOMATERIALS:** Classes of nanomaterials, Surface physical-chemical properties, Gold and silver nano particles, microbial synthesis of gold nano structure.

#### **UNIT III**

**4 hrs**

**CHARACTERISATION OF NANOMATERIALS:** AFM, STM, SEM, TEM, XRD, UV-DRS, of nanomaterials for structural & chemical nature.

#### **UNIT IV**

**4 hrs**

**ENVIRONMENTAL IMPACTS OF NANOMATERIALS:** Toxic Impacts of Nanomaterials, Exposure and risk assessment, Dose-response, Mechanisms of toxicity.

**UNIT V**

**4 hrs**

**ENVIRONMENTAL APPLICATIONS:** Environmental remediation, Nanomaterials for ground water and wastewater treatment, Adsorbents and Antimicrobial Nanomaterial, Disinfection and membrane process.

**Suggested Readings:**

1. Environmental Nanotechnology: Applications and Impacts of Nanomaterials. Mark R. Wiesner, Jean-Yves Bottero (editors). McGraw-Hill, New York, ©2007.
2. Environmental Applications of Nanomaterial-Synthesis, Sorbents and Sensors, edited by Glen E Fryxell and Guozhong Cao, worldscibooks, UK
3. The Chemistry of Nanomaterials, Synthesis, Properties and applications. Edited by C.N.R.Rao.
4. Handbook of Nanotechnology, Edi-Bharat Bhushan, Springer, 2004
5. Nanotechnology Applications for Clean Water. Mamadou Diallo, Jeremiah Duncan, Nora Savage, Anita Street, and Richard Sustich (Editors). ISBN: 978-0-8155-1578-4. William Andrew ©2008.
6. Environmental and Human Health Impacts of Nanotechnology. Jamie Lead & Emma Smith. ISBN: 978-1-4051-7634-7. John Wiley & Sons ©2009.
7. Nanobiotechnology: Concepts, Applications and Perspectives. Christof M. Niemeyer & Chad A. Mirkin (Editors). ISBN: 978-3-527-30658-9. John Wiley & Sons ©2004.



# हिमाचल प्रदेश केंद्रीय विश्वविद्यालय Central University of Himachal Pradesh

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PO Box no. 21, Dharamshala, Distt. Kangra, Himachal Pradesh- 176215

**(Temporary Academic Block, Shahpur)**

**Course code: ENV 521**

**Course Name: Geo-Engineering**

**Teacher: Prof A.K. Mahajan**

**Credits Equivalent:** 2 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Aim:** The main thing is to introduce the student to concepts and applications of geophysics to solving environmental and engineering problems.

**How course activities and course structure help students achieve these goals:**

The course is designed to give them the background knowledge and practice using several methods in order to encourage them to think about the utility of geophysics in the solution to problems of an environmental nature.

## **Course Objective**

The student will deal with different geo-engineering techniques are used by industry and academia to solve environmental problems. The student will analyze and integrate the physical theory, field methodology, and interpretation of each method with geologic and engineering information to solve problems using real data sets. The student will also summarize and critique recent publications in the fields of engineering and environmental geophysics.

## **Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

## **Evaluation Criteria:**

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25% (Breakup is following)

- a. Assignment/Quiz/Term Paper: 20%
- b. Presentation/Seminar/Field work: 20%
- c. Practical: 60%

### **Course content**

Unit-1 Importance of geology in civil engineering: geological properties of rocks used in civil engineering- porosity, density, absorption. Effects of load imposed on rocks and stones - compressive stress and strength of rocks, tensile stress, tensile strength, elasticity of rocks. Geological properties of stones and road materials. **4 hrs**

Unit-2 Geological considerations in construction of dams, its parts and its types. Silting and de-silting of dam reservoirs. Types of bridges and tunnels and geological considerations for construction of tunnels and Bridges. **4 hrs**

Unit-3 Landslides and classification, its causes and effects. Slope ,slope angle, and slope analysis, angle of repose. **4 hrs**

Unit.-4 Problems of ground water in engineering projects. Geo technical study of Bhakra Nangal projects. **4 hrs**

Unit-5 Instrumentation in Geo-engineering like Standard penetration test, Spectral analysis of surface waves and Multichannel analysis of surface waves for shear wave velocity/ stiffness of the soil column and their applications Case studies with type example. **4 hrs**

### **Text Books:**

1. Parbin Singh: Engineering and General Geology. KatsonPubl House
2. Sharma, P.V., (1986). Geophysical Methods in Geology. Elsevier, London
3. Kryine, D.H. and Judd, W.R. (1998). Principles of Engineering Geology, CBS Edition, Delhi.

### **Additional Readings:**

4. Valdiya, K.S., (1987). Environment Geology-Indian Context. Tata Mcgraw Hill. N.Delhi.
5. Geotechnical earthquake Engineering by Kamer S.L. 2003. Prentice Hall Publ.

Lectures	Topics	Prescribed Text Book
1	Importance of geology in civil engineering: geological properties of rocks used in civil engineering- porosity, density, absorption.	<b>Course content provided by teacher in addition to books recommended</b>
2	Effects of load imposed on rocks and stones - compressive stress and strength of rocks	<b>Course content provided by teacher in addition to books recommended.</b>
3	Stress, strain and tensile stress, tensile strength, elasticity of rocks	<b>Course content provided by teacher in addition to books recommended.</b>
4	Geological properties of stones and road materials.	<b>Course content provided by teacher in addition to books recommended.</b>
5	Geological considerations in construction of dams, its parts and its types	<b>Course content provided by teacher in addition to books recommended.</b>
6	Silting and de-silting of dam reservoirs.	<b>Course content provided by teacher in addition to books recommended.</b>
7	Types of bridges and tunnels	<b>Course content provided by teacher in addition to books recommended.</b>
8	Geological considerations for construction of Tunnels and Bridges.	<b>Course content provided by teacher in addition to books recommended.</b>
9-12	Landslides and classification, Its causes and effects, Slope ,slope angle, and slope analysis, angle of repose and finally case study	<b>Course content provided by teacher in addition to books recommended.</b>
13-16	Problems of ground water in engineering projects. Geo technical study of Bhakra Nangal projects. Instruments used in locating ground water in different environments, use of toposheet in locating water bodies, Use of Water resources information system.	<b>Course content provided by teacher in addition to books recommended.</b>
17-20	Instrumentation in Geo-engineering like Standard penetration test, Spectral analysis of surface waves and Multichannel analysis of surface waves for shear wave velocity/ stiffness of the soil column and their applications Case studies with type examples	<b>Course content provided by teacher in addition to books recommended.</b>



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PO Box no. 21, Dharamshala, Distt. Kangra, Himachal Pradesh- 176215  
**(Temporary Academic Block, Shahpur)**

**Course Code: ENV 577**

**Course Name: Carbon Management**

**Credits Equivalent:** 2Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory;/ literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

**Course Objectives:** Course will provide scientific understanding of Carbon Management or sequestration and develop to the point of deployment those options that ensure environmentally acceptable sequestration to reduce anthropogenic CO<sub>2</sub> emissions and/or atmospheric concentrations.

**Attendance Requirement:**

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination

**Course Contents:**

**Unit 1: Introduction of carbon management**

Background concepts, Change in carbon pools, management plans are focused on (a) minimizing emission (b) maximizing environmentally sound reuse, reduce and recycling; (c) effective treatment and (d) converting carbon into valuable products with atom economy.

**Unit 2: Chemical Methods for carbon management**

Various chemical reaction involved in carbon management like as Kolbe-Schmitt, Carboxylation, cyclization, polymerization, amination, Boudouard reaction, Friedel-Crafts acylation, Reductive hydrogenation, photochemical and Formate-metal complex reactions, Carbon capture from adsorbents, Membrane based separation

**Unit 3: Biological Methods for carbon management**

Biological sequestration relates to the use of higher plants and micro-organisms, Microbial electrosynthesis, Symbiosis (in *vivo* associations of plant and microbes). Chemical-biological Hybrid modification

**Unit 4: Carbon capture and Utilization**

Carbon capture and Utilization; biotechnological interventions for carbon dioxide capture and utilization, options for mitigating methane emissions, carbon sequestration and organic farming

### **Unit 5: Modification in carbonic anhydrase (CA)**

Modification in CA in terms residue and group as target. Residue specific modification involving ligand-ligand interaction in terms of substitution/addition and group specific modification targets the various functional groups. Role of metal interaction and solvents/medium.